

CLAIMS

What is claimed is:

- 1 1. A method of preventing or reducing the severity of renal damage due to a blood-
2 borne substance that is toxic to the kidneys of a human or veterinary patient, the
3 method comprising the steps of:
4 positioning an endovascular heat exchange device in a blood vessel of the
5 patient; and
6 using the endovascular heat exchange device to cool at least the patient's
7 kidneys to a temperature at which the substance-induced renal damage is
8 prevented or reduced in severity.
- 1 2. A method according to Claim 1 wherein the endovascular heat exchange device is a
2 catheter having a heat exchange region.
- 1 3. A method according to Claim 1 wherein the endovascular heat exchange device is a
2 catheter having a heat exchange region, the heat exchange region comprising at
3 least one heat exchange balloon through which heat exchange fluid is circulated.
- 1 4. The method of claim 3, further comprising a step of inflating the heat exchange
2 balloon by circulating heat exchange fluid therethrough.
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- 1 5. A method according to Claim 1 wherein the endovascular heat exchange device
2 comprises a heat exchange region that is metallic.
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- 1 6. A method according to Claim 1 further comprising a step of disrupting laminarity of
2 blood flow around the endovascular heat exchange device.

- 1 7. A method according to Claim 1 wherein the endovascular heat exchange device is
2 positioned proximate the patient's heart to cause a reduction in the temperature of
3 the blood flowing through the patient's heart.
- 1 8. A method according to Claim 1 wherein the step of reducing the patient's
2 temperature is performed prior to administering the substance to the patient.
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- 1 9. A method according to Claim 1 further comprising a step of maintaining the reduced
2 temperature of the patient during the administration of the substance to the patient.
- 1 10. A method according to Claim 1 further comprising a step of maintaining the reduced
2 temperature after the administration of the substance to the patient.
- 1 11. A method according to Claim 1 wherein the patient's body temperature is reduced
2 below 37 degrees Celsius.
- 1 12. A method according to Claim 1 wherein the patient's body temperature is reduced
2 to a temperature between 32 degrees Celsius and 37 degrees Celsius.
- 1 13. A method according to Claim 1 further comprising a step of administering an anti-
2 shivering treatment to the patient to reduce shivering caused by reducing the
3 temperature of the endovascular heat exchange device.
- 1 14. The method of claim 13, wherein the anti-shivering treatment is a blanket.
- 1 15. The method of claim 13, wherein the anti-shivering treatment is an anti-shivering
2 agent.
- 1 16. A method according to Claim 1 wherein the kidney damage is the result of the
2 administration of radiographic contrast medium.

17. A method according to Claim 1 wherein the kidney damage is contrast medium-induced nephropathy.
18. A method according to Claim 1 wherein the kidney damage is due to the ingestion, absorption, formation or exposure to a nephrotoxic drug or substance.
19. A method according to Claim 18 wherein the nephrotoxic drug or substance is selected from the group consisting of non-steroidal antiinflammatory drugs (NSAID's), amphotericin, cisplatin, methotrexate, acyclovir, gentamicin, acetylcholinesterase inhibitors, other nephrotoxic drugs, products of tumor lysis and products of rhabdomyolysis.
20. A method according to Claim 20 wherein the patient has received an overdose of a nephrotoxic drug or substance and wherein the method further comprises the step of:
 - making at least a preliminary diagnosis of overdose with a nephrotoxic substance prior to using the endovascular heat exchange device to cool at least the patient's kidneys.
21. A method according to Claim 1 wherein a kidney or a portion of the body including a kidney is cooled and wherein the method further comprises:
 - positioning a first endovascular heat exchange device in a first blood vessel of the patient through which blood flows to at least one of the patient's kidneys;
 - positioning a second endovascular heat exchange device in a second blood vessel of the patient through which blood flows from at least one of the patient's kidneys;
 - using the first endovascular heat exchange device to cool blood flowing to at least one of the patient's kidneys; and,

using the second endovascular heat exchange device to warm blood flowing from at least one of the patient's kidneys.

22. A method according to Claim 1 wherein a kidney or a portion of the body including a kidney is cooled and wherein the method further comprises:

positioning a first endovascular heat exchange device in the aorta upstream of the location at which a renal artery branches from the aorta;
positioning a second endovascular heat exchange device in the aorta downstream of said location at which a renal artery branches from the aorta;
using the first endovascular heat exchange device to cool blood flowing through the aorta, a portion of which flows into the renal artery; and,
using the second endovascular heat exchange device to warm the remaining blood flowing through the aorta after the portion has flowed into the renal artery.

- 1 23. A method according to Claim 1 further comprising a step of monitoring the
2 temperature of the patient.

- 1 24. A method according to Claim 1 further comprising steps of:
2 monitoring the temperature of the patient; and
3 adjusting the temperature of the heat exchange catheter based on the temperature
4 so monitored.

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- 3 25. A method for preventing or reducing the severity of kidney damage in a human or
4 veterinary patient due to the administration, ingestion, absorption or production of,
5 or exposure to, a nephrotoxic substance, said method comprising the steps of:
6 providing a heat exchange catheter that has a heat exchanger which is positionable
7 within a blood vessel of the patient and a controller that controls the temperature
8 of the heat exchanger;

9 positioning the heat exchanger in a blood vessel of the patient without entirely
10 preventing the flow of blood around the heat exchanger; and
11 controlling the temperature of the heat exchanger to reduce the temperature of the
12 patient's blood and to cool the patient's kidneys, thereby preventing or reducing
13 the severity of kidney damage.

1 26. The method of claim 25, wherein the patient's kidneys are cooled prior to the
2 administration of the substance to the patient.

1 27. The method of claim 25, wherein the patient's kidneys are cooled during the
2 administration of the substance to the patient.

1 28. The method of claim 25, wherein the patient's kidneys are cooled after the
2 administration of the substance to the patient.

1 29. The method of claim 25, further comprising the step of maintaining the reduction in
2 temperature during the administration of the substance to the patient.

1 30. The method of claim 25, wherein the heat exchange catheter comprises at least one
2 balloon containing a heat exchange fluid.

1 31. The method of claim 30, wherein the at least one balloon is disposed at the distal
2 end of the heat exchange catheter.

1 32. The method of claim 25, further comprising a step of disrupting the laminar flow of
2 blood around the heat exchange catheter.

1 33. The method of claim 32, wherein the laminar flow of blood is disrupted by one or
2 more fins provided on the heat exchange catheter.

- 1 34. The method of claim 25, wherein the heat exchange catheter is positioned in the
2 patient's venous system.
- 1 35. The method of claim 30, wherein the heat exchange catheter is positioned in the
2 patients inferior or superior vena cava.
- 1 36. The method of claim 20, comprising reducing the temperature of the patient's
2 kidneys to a temperature that reduces ischemic injury of the kidney.
- 1 37. The method of claim 20, comprising reducing the patient's temperature to a
2 temperature between 32 degrees Celsius and 37 degrees Celsius.
- 1 38. The method of claim 20, further comprising a step of administering an anti-shivering
2 treatment to the patient.
- 1 39. The method of claim 38, wherein the anti-shivering treatment is an anti-shivering
2 agent selected from the group consisting of: dopamine receptor blockers;
3 dopamine receptor agonists; kappa opioid receptor agonists; opioid agonist-
4 antagonist analgesics; serotonin 5HT1a receptor agonists; and their
5 pharmaceutically acceptable salts.
- 1 40. The method of claim 25, further comprising a step of monitoring the temperature of
2 the patient.
- 1 41. The method of claim 25, further comprising steps of:
2 monitoring the temperature of the patient; and
3 adjusting the temperature of the heat exchange catheter based on the temperature
4 so monitored.

42. A system for preventing or reducing the severity of renal damage due to a blood-borne substance that is toxic to the kidneys of a human or veterinary patient, said system comprising:
a heat exchange catheter insertable into a blood vessel of the patient; and
a temperature controller in communication with the heat exchange catheter to cause the heat exchange catheter to reduce the temperature of at least the a patient's kidneys to a temperature at which the substance-induced renal damage is prevented or mitigated.
- 1 43. The system of claim 42, wherein the heat exchange catheter comprises at least one
2 balloon containing a heat exchange fluid flowing from the temperature controller.
- 1 44. The system of claim 42, wherein the at least one balloon is circumferentially
2 disposed about the catheter to direct the heat exchange fluid in an opposite
3 direction of blood flowing past the catheter.
- 1 45. The system of claim 42, wherein the temperature controller includes
2 temperature monitoring means for monitoring the patient's temperature; and
3 temperature adjusting means for adjusting the temperature of the heat exchange
4 catheter to maintain a constant reduced temperature of the patient's kidneys.
- 1 46. The system of claim 45, wherein the temperature adjusting means adjusts the
2 temperature in response to the temperature monitored by the temperature
3 monitoring means.
- 1 47. The system of claim 42, wherein the heat exchange catheter comprises a flow
2 disruption device to disrupt the laminarity of blood flow around the catheter.
- 1 48. The system of claim 42, wherein the temperature controller controls the temperature
2 and flow of heat exchange fluid flowing through the heat exchange catheter.

1 49. The system of claim 42, further comprising an anti-shivering element.

1 50. The system of claim 49, wherein the anti-shivering element comprises a blanket.

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3 51. The system of claim 49, wherein the anti-shivering element comprises a quantity of
4 an anti-shivering agent and apparatus for administering that anti-shivering agent to
5 the patent.

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7 52. The system of claim 51 wherein the anti-shivering agent is selected from the group
8 consisting of: dopamine receptor blockers; dopamine receptor agonists; kappa
9 opioid receptor agonists; opioid agonist-antagonist analgesics; serotonin 5HT1a
10 receptor agonists; and their pharmaceutically acceptable salts.

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